

THE ECLIPSE EXPEDITION AT VIZIADURG.

I.

SO much of the material acquired to science by the observations of the last total eclipse of the sun in India has now been published by the Royal and other Societies, that I now propose to give in the columns of NATURE a connected account of the work done and arrangements adopted at Viziadurg.

Four of us left London in the R.M.S. *Lusitania* on December 10, 1897, and that vessel reached Colombo on January 4, 1898. As we steamed into the harbour, about 1 a.m. on the 4th, the first ship we passed was Her Majesty's ship *Melpomene*, many lighted, white painted, her hull appearing phosphorescent in the dark night. Long before the *Lusitania* was moored, Lieut. Colbeck, R.N., of the *Melpomene*, and an officer of the Customs Department were on board, and such complete arrangements had been made that a few minutes after the mails

We left Colombo at 5 p.m. on the same day. On the morning of the 5th (Wednesday) we sighted Cape Comorin, and in the early evening I explained, by means of lantern slides thrown on a screen under the bridge by an eighty-candle glow-lamp, the kind of work done during an eclipse, and how the ship's company of the *Volage* had organised themselves in 1896. When my talk was over, Captain Batten called for volunteers. To my delight and astonishment, and I must say rather alarm, about 120 officers and men at once stepped forward. Now that, of course, meant incessant school till the moment of the eclipse. However, we were all quite prepared for it, although it was evident that the Eclipse party of three had their work cut out for them.

The next delightful thing I found was that three or four of the officers of the ship were just as competent to give instructions on the various lines of work to be attempted as my assistants and myself were, so that the teaching was put into a very big commission.

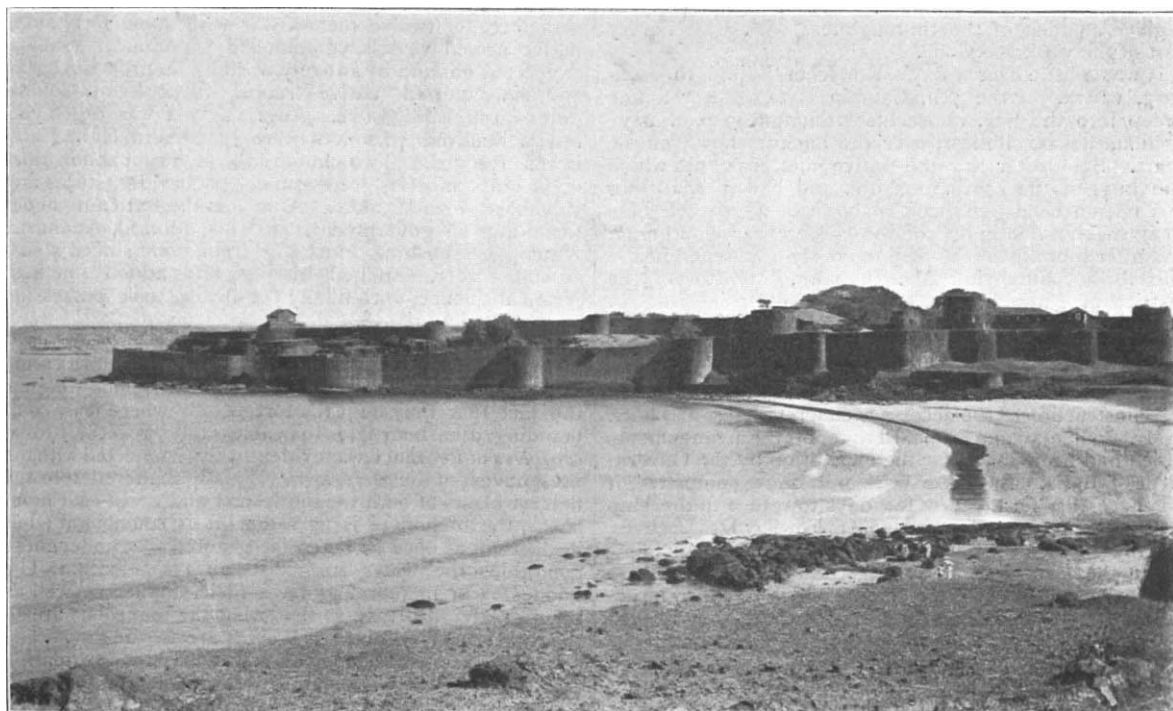


FIG. 1.—The Fort.

had been put into one lighter, the instruments, which had been brought on deck the day before, were being delicately handled into another. There was therefore no sleep for any of us that night, and early in the morning Captain Chisholm-Batten, R.N., of the *Melpomene*, came on board. Shortly afterwards the eclipse party, with all their gear, were transferred from the mail steamer, after taking leave of Captain Veale and his officers, to the cruiser.

It did not require a keen observer to find out, after a very short time on board, that the *Melpomenes* had made up their minds to emulate the doings of their comrades on the *Volage*, in connection with the Varanger Fjord eclipse of August 1896, and also that this was in part due to the keen interest taken by Captain Chisholm Batten in all things scientific. He very soon put exactly the same question to me that Captain King-Hall had done two years before on the *Volage*, and I gave him the same reply. He said, "If you will explain to the ship's company what is wanted I will call for volunteers, and then we will see what can be done." I did as I was told.

This was an intensely interesting day to me, for while arrangements for the eclipse of 1898 were thus advancing, the *Melpomene* was following the sea-track of the flagship *Glasgow*, which carried the expedition of 1871. Cannamore was first passed, and later on Baikul, where my station was seven-and-twenty years ago. Heigh ho! Why is one not always young and full of energy, and why should the power of doing dwindle as one knows better what to do? But that is another story.

We began our drills the same night. An important part of the work was to get an idea of the outlines of the corona, and for that purpose I had taken out several discs which would hide the more luminous lower parts of it in order to shield the observers' eyes, so that they would be in the best possible position to note the delicate tracery outside. In addition to that, a large party had volunteered for drawing the corona, so we started drawing competitions; we had marks for form and for colour of the corona. For this purpose the ship rigged up a magic-lantern by means of one of the incandescent

lights. We found a capital screen on deck in the shape of one of the casings; drawings and photographs (coloured) of the corona were thrown on the screen and copied under eclipse conditions. What do I mean by eclipse conditions? I mean this: experience shows that when the eclipse begins you must tell everybody how many seconds are left, otherwise they will lose time by trying to find out for themselves; if the eclipse is going to last 170 seconds, at the instant of totality we tell them so. After 10 seconds we say, "You have 160 seconds more"; after 20 seconds we tell them they have 150 seconds more, and so on, in as encouraging a way as we can. We adopted this plan in our practising.

The next thing which delighted me was, that not only was every rating in the ship represented two or three times over in the volunteers, but that almost all the men who volunteered to make these drawings had colour-boxes. Where they get them from I do not know, but colour-boxes they had. In the examination we gave 10 marks for colour and 10 for form; several of them got 18 out of a possible 20 marks. I mention that because it gives an idea of the thoroughness with which every part of the work was done.

It was a little over a day's run from Baikul to Viziadurg, where, on the 7th, Captain Batten, after a fine sweep into the bay, chose his station at 3 p.m. navy fashion, that is, pilotless, over the anchor shown on the chart. Soon after this the native pilot, in a boat which had hugged the southern shore, and had, perhaps, for this reason been unnoticed in spite of a tattered blue ensign with a lion in one of the corners, came on board, and after him a boat full of gorgeously-apparelled native officials accompanying Mr. Bomanji, Collector of the district of Ratnagiri, in which Viziadurg is situated, among them an overseer of the Public Works Department, who was on the spot in charge of some most excellent masons and carpenters, picked men from Ratnagiri as we later ascertained, and plenty of material for the construction of the necessary concrete bases and huts.

Mr. Bomanji came on board to report the arrangements which had been made for the expedition by the Government of India. As these were not quite completed, it was necessary for the first few days to return to the ship every evening, but afterwards Mr. Fowler, Dr. Lockyer, and myself took up our quarters at the Dak bungalow inside the fort, close to the instruments. Meals were provided at the Collector's camp, which was also inside the fort.

A party was landed at the fort on the afternoon of our arrival, Saturday, January 8, to inspect the site suggested by Mr. Bomanji, and it was at once evident that it would satisfy all requirements, provided the fluctuations of temperature of the great masses of masonry composing the fort had no disturbing influence on the steadiness of the air. In order to investigate this point a $3\frac{3}{4}$ -inch telescope was set up, and observations of the surrounding landscape, and, at dusk, of various stars, were made, from which it appeared that the atmosphere was sufficiently steady for the observations.

We found a considerable number of coolies was also present to do such work as carrying packing-cases, sawing wood, clearing the camp, &c.

In the fort was also a police guard sent from Ratnagiri. The camp was watched both by day and night so effectively by them that no damage to any instrument was reported.

Description of Viziadurg.

Viziadurg, we found, is practically concentrated in its fort. A former collector of the district, Mr. Sinclair, had been good enough to send me a photograph of it. On landing, after the collector's visit, we found that the real thing is certainly far more extensive than the photograph suggested, and more than this, the building and its

history are both of very high interest. The fort dates from the fourteenth century, but it was much strengthened in the sixteenth, when the towers and triple walls, the well-preserved ruins of which now encircle it, were added. These towers number twenty-seven; they rise to 100 feet, and, like the massive walls, are built of large blocks of stone, now coloured dark red, and almost black in places. The walls enclose about twenty acres, and within this space are habitable buildings, two wells, and a water reservoir, formerly lined with lead at the bottom and to about 10 feet up the sides, larger than the largest of the celebrated tanks at Aden. From the beginning of the sixteenth century the fort was the headquarters of piracy in the Indian seas. Kanhoji Angria, the admiral of the Maratha fleet, became a renowned corsair, and at his death was ably succeeded by his son, Julaji Angria. These gentlemen seemed to have had it all their own way. They respected no flag, captured many ships, sacked the coast towns, and, worst of all, repelled several expeditions sent against them by the English, Portuguese and Dutch. Julaji only finally surrendered in 1755 to a force of twelve men-of-war with some forty small native armed vessels, commanded by Admiral Watson, supported on land by an army of eight hundred European and six hundred native troops, under Lieut.-Colonel (afterwards Lord) Clive. Angria's fleet was destroyed, fifteen hundred prisoners were taken, and eight Europeans rescued. Two hundred and fifty cannon and eight brass mortars were found, and besides, stores and valuables worth 125,000*l.* After this the fort came under the Peshwa's government, and his admiral, Anandrav Dholup, establishing himself therein, commenced a successful career, enriched himself, and added much to piratical science, until finally the British took possession of the district in 1818.

If the final cause of the pirates of Viziadurg was, as it seems to have been, the formation of an Eclipse camp, even to providing unexpended bombs for clock weights, the fact that they built the fort exactly where it is, commanding a harbour finer than that familiar to their-to-be *confrères* of Penzance, was evidently also connected with the present visit of the *Melpomene*. Equally sheltered from the fiercest blasts of both the south-west and north-east monsoons, the anchorage is as safe as it is convenient; but it must not at once be taken for granted that under these conditions the water surface is always smooth. The goddesses of meteorology have their smaller as well as their greater festivals, so that what the monsoons are to the year the land and sea breezes are to the day. The sea breeze sets in about noon with marvellous regularity, and is at its height about sun-down; as the night advances everything becomes calm, and at ten o'clock even the rattle of the jalousies in the windows of the fort has entirely ceased.

Precautions and Preparations.

While considering the desirability of establishing a station at Viziadurg, a friend of great Indian experience was loud in his praises of the Konkan as a health resort. He expressed his astonishment that yachtsmen, who generally know what is good for them, so constantly neglect to spend some winter months on a coast so delightful in many ways. Our experiences entirely justified my friend's views. Of course, great precautions have to be taken when so much work has to be done in the sun; but my Baikul experience told me the conditions are much better at Viziadurg than they are in South Canara. The sun's rays were almost always tempered by a breeze; the temperature at 8 a.m. was often about 70 degrees, and on shore 85 degrees was reached later on in the day.

Next morning, Sunday, January 9, the instruments were landed absolutely without the slightest difficulty. With reference to this a few words may be said concerning the

preparations for an Eclipse Expedition, since few people have any idea of the labour involved or of the precautions to be taken. In the first place, all the instruments to be taken out must be adjusted for the place chosen for observation; that is, the so-called "Polar axis," on which each instrument turns, must be directed to the position which will be occupied by the pole star at the Eclipse station. Thus, while in London the axis points in a direction of $51\frac{1}{2}$ degrees from the horizontal, in India this direction was about $16\frac{1}{2}$ degrees. The instruments must then be made to work under these new conditions, and each position of all the optical portions which produces the best results must be marked most carefully, either by screwing down or by lines of white paint, so that each can be exactly replaced at the station. Then comes the taking down and packing. On this point I got a lesson in 1882 at Siout, in Egypt, which I shall never forget. It was a question of getting a stand, weighing about 3 cwt., of an equatorial telescope into the Khedive's yacht. There was no tackle, and the thing was got on board by the Egyptian authorities flogging a giant Soudanese up a plank with the stand on his back. Since then, in all the expeditions I have had to do with, all stands have been built upon the spot by filling a wooden and paper model with concrete; and, further, no packing case has weighed more than 60 lb.; this enormously simplifies boat service. All mirrors and plates must be hermetically sealed up, parts of different instruments must not be mixed together in the packing cases, and all cases containing pieces of the same instrument must have the same index letter. As a result of this system we took to Vizadurg eighty cases, on which the skilled packers employed at the South Kensington Museum expended infinite care; they were all small and numbered and lettered, so that they could be easily landed the moment the sites for the several instruments were settled. The local labourers, under the efficient superintendence of the Public Works Department, had no difficulty in sorting the cases.

It was important to erect the huts as soon as possible, not only to shelter the instruments but the observers from the sun. Among the precautions taken in the camp I may mention that 10-foot square screens of excellent matting made locally and stiffened with bamboo were temporarily erected to the sunward of every working party, both at morning and evening. When it was necessary to go on with the

work at mid-day, the same screens were supported over the workers by bamboos. As each instrument was erected it was permanently protected in the same manner.

With these precautions, and with such a climate, no one was sick.

The concrete pillars for the instruments were begun the day we landed. The men were brought on shore in the early morning in order to do the drills and erect the various instruments and all sorts of other work which turned up; but we had to knock off in the middle of the day in consequence of the extreme heat. It was very convenient for us that the *Melpomene* could lie at such a short distance from the camp that it did not take more than a quarter of an hour for the various parties to get to work. A signal station was at once established, so that, as at Kiö in Lapland, we could at once communicate with the ship in case anything were wanted.

In camp the work was incessant from sunrise to midnight, excluding the break in the middle of the day.

The instruments were set up as soon as their bases were ready. Mr. Fowler and Dr. Lockyer were enabled to report all the fixed instruments and huts, eight in number, erected and all but the final adjustments made after six days' work. Constant clear skies enabled all the adjustments to be made without difficulty, and by January 17 all the instruments were ready.

Life on Shore.

It became necessary on Tuesday, January 11, to transfer our quarters from the ship to the shore, as the erection of the instruments was by that time advanced to such a stage that it was possible to test the various adjustments by observations of stars. This change of front was accompanied by some difficulty, for many telegrams had been received telling us, now that this, now that that, was the shore arrangement which had been approved by the authorities, in one case of the Supreme Government, in the other of the Government of Bombay. The officials of the Bombay Government, in spite of letter from home of old date stating the exact opposite, were firmly convinced that independently of the supply of material for huts, the organisation of the camp and all the astronomical night-work on shore was a question of a tiffin basket; that it

was rather exhilarating than otherwise in the climate of India to remain on shore with the aforesaid basket till one o'clock in the morning, and reach it again at sunrise.



FIG. 2.—General view of camp.

They were also of opinion that a man-of-war of some three thousand tons could lie practically alongside the fort; that there was sleeping and other accommodation in a third-class cruiser for any number of shore hands; and finally, that it was open to anybody to walk on board and claim it.

The phantasmagoria of telegrams ceased on Saturday, and Captain Batten, who had insisted on sending his steward on shore to look after us, was no longer dependent on the wardroom mess for his meals. As we had no servants and could not get any, he sent two Seedie boys to look after us and see to the lamps at night, which they did most satisfactorily. I was once more in the land of pantomime, and again came to the conclusion that after all spoken language may be a needless survival. The Collector, camping out some little distance away from the observatory, was now our host, and we had to thank him for unceasing forethought and kindness. We lunched and dined with him, and he supplied me with an interpreter, which facilitated matters greatly.

It took us some time to get through all Customs formalities, and the difference between Ceylon and Bombay methods we found curious. At Colombo, before the *Lusitania* had come to her moorings, Mr. Halliday, an officer of the Customs Department, came on board with a letter from Mr. Lionel F. Lee, the principal Collector of Customs, offering all possible assistance in landing and transshipping baggage and instruments. The Bombay officials were evidently of the opinion that the *Melpomene*, instead of coming from her station at Calcutta, had arrived straight from home full of contraband. The local official followed me round the camp with a bundle of forms, until at last, in despair, I informed him that, to my regret, I did not know the precise value of each article of wearing apparel brought out, but that all trunks could be opened for inspection on landing, and I would make any payment he might demand.

Our quarters in the fort were not without interest. They were in a building much more modern than the fort itself, and consisted of two rooms and a verandah on the first floor, approached by external stone steps. The ground floor, a little below the general level, we devoted to a dark room and a general store-room for the more delicate parts of the instrumental equipment. In each of the upper rooms, which were white-washed, with sanded floors, there was a bedstead, a chair and a tub; and after all, what more does one really want? I should add that there was also a looking-glass of much more gorgeous make, which did good service by blocking a door of which the fastening had given way. Further, in one of the bed-rooms there was a small table, now used for gastronomic and now for astronomic purposes. But the real furniture, both of rooms and verandah, were the pictures on, or rather in its walls. I mean the views from the windows when the jalousies were opened, especially some little time before sunrise and after sunset. I have never seen such effects of gorgeous, indescribable colours. Why was Lippmann not there to catch these colours, unknown in Europe—the fierce contrasts between the water and the land; between the beautiful river valley and the open sea; between the hard outlines of the gloomy ramparts below and the delicate landscapes which seem to float above them in the gloaming; and, finally, between the pure white of the *Melpomene* and the blue water on which she floated—a blue which at certain times of the day put the blue of the Mediterranean into the shade!

Of mosquitoes there were none; indeed, the absence of insect life was remarkable; of snakes we saw few, though the region has a very bad reputation, so bad that in 1876 the sum of 441*l.* was expended in killing 141,000. Of course, precautions were taken. Dr. Lauder Brunton and Prof. Fraser were good enough to provide me with the latest things in remedies, including *serum anti-*

veneux, which I handed over to Dr. Nolan, who posted up full instructions as to their use; but as this is a matter where prevention is better than cure, leggings by day and lamps by night were used by everybody.

And now a few words about the growth of the camp. The first shelter erected was for the use of the signalmen, for one of the guiding principles has been that no one need work in the sun unless he likes, and at the very first it was necessary that there should be signalmen to connect the camp with the ship. In relation to this first shelter, an idiosyncrasy of the blue-jacket, which I had a previous opportunity of studying at Kio, came out. On landing in the morning I found this shelter already christened "Flaggies Villa"; the sailors on the staff of the other instruments were not going to be outdone, and as their shelters went up one got the idea of a village fair, for each carried a sign as I have previously mentioned: the 6-inch equatorial, of which Prof. Pedler arrived to take charge on the 13th, was the "Town Hall"; the 9-inch prismatic camera lived in "Mainsail Hall"; the 6-inch prismatic camera under Mr. Fowler's charge was accommodated in the "Central Hotel." The very much occupied hut which covered the cœlostæt and the instruments which it feeds with light, that is, the integrating spectroscope and the two coronagraphs, was named the "Empire Palace." The whole fort was named "Batten's Camp," and the wall on which the discs were placed was called the "Common Hard"—the ship hailed from Portsmouth—and so on. In three or four days there was not a place which had not a name, and a very good name too.

The Lectures and Drills.

The lectures went on steadily from January 5 to 17. They were given by many of the ship's officers as well as by members of the Expedition.

The first drills of the work to be done at the chief instruments during the eclipse took place on the 13th. This statement, perhaps, requires some explanation. When a large instrument is brought out so great a distance to observe a fleeting phenomenon it is natural to try and get out of it the greatest possible amount of work. To secure this the greatest possible division of labour is the first and indeed the chief requirement. This means that many heads and hands must be employed in each of the operations necessary, and this spells drill, unceasing drill.

Now, if this crowd does not work together without the slightest hitch, failure is certain. I do not think I need say more as to the necessity for constant drill, but with regard to the complete operations something more than drill is necessary. With about 120 observers and helpers, on the principle of cutting the coat according to the cloth, a pretty large programme is permissible. When once this is settled, and the volunteers have selected a branch of the work in which they think they can render most efficient help, instruction as to the special points must be imparted. This was done without stint and almost entirely by the officers, and with such a will and skill that my own superfluity on the stage became increasingly obvious day by day. While this set one thinking in one direction along lines not untinged with regrets, in another there was great cause for rejoicing, for it will be a grand day for solar physics when the observations of eclipses will be among the recognised duties of a ship, such as the present one, on the station with a sufficient crew to tackle it.

While the instruments were being set up, one of the chief things accomplished was to organise the whole effort, so that when things were ready everybody could work together. As the number of volunteers was so large, I pointed out to Captain Batten, who had volunteered to aid in a special branch of the work, the

importance of his taking charge of the whole camp and giving all the necessary orders for conducting the operations during the general rehearsals and the eclipse itself. He eventually agreed to this, and the procedure and time signals were arranged between us. To me, an old eclipser, it was a beautiful thing shortly afterwards to see the splendid drill commenced in eclipse form, along all lines, going on to the sound of the bugle.

It was found that with such a large number of volunteers we could practically undertake almost every kind of work which had ever been attempted during an eclipse. The

Commandership (K.C.B.) of the Order of the Bath, and Major-General Festing has been created a Companion of the same Order (C.B.). Dr. Patric Manson, medical adviser to the Colonial Office, has been appointed a Companion of the Order of St. Michael and St. George (C.M.G.).

A WELL-ATTENDED meeting of the members of the Palæontographical and Ray Societies was held at the Geological Society's Apartments, Burlington House, on Tuesday, December 19; the Rt. Hon. Sir John Lubbock, Bart., M.P., President of the Ray Society, in the chair. The object of the joint meeting was to

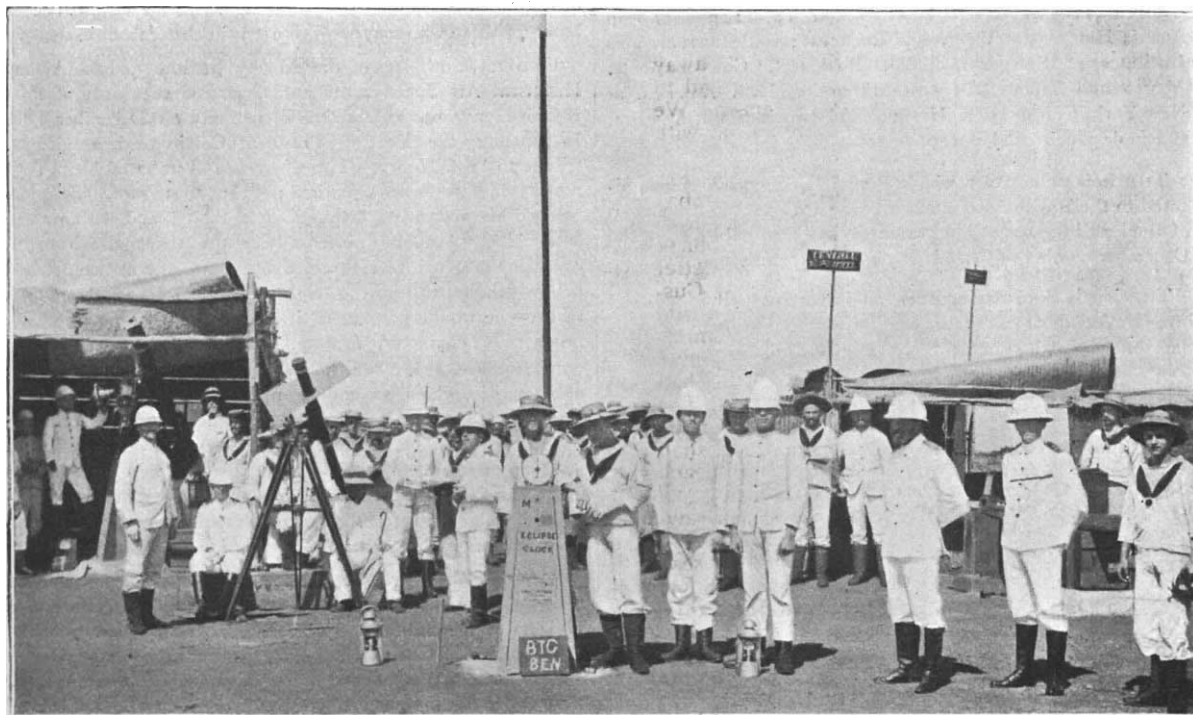


FIG. 3.—Preparing for a rehearsal. Captain Chisholm-Batten and time-party at the eclipse clock.

observers were divided into twenty-two groups, each in charge of a responsible person.

The groups of observers were as follows :—

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|---------------------------------------|--|
| (1) Time. | (13) Hand spectroscopes. |
| (2) 6-inch prismatic camera. | (14) Prisms for rings. |
| (3) 9-inch " " | (15) Polariscopes. |
| (4) Integrating spectro-scope. | (16) Landscape colours. |
| (5) 6-inch equatorial. | (17) " cameras. |
| (6) Coronagraph. | (18) Shadow phenomena. |
| (7) Discs. | (19) Kinematograph for eclipse. |
| (8) Sketches of corona without discs. | (20) Kinematograph for shadow. |
| (9) 3½-inch equatorial. | (21) Contact observations. |
| (10) Observations on stars. | (22) Observations on natives, animals, &c. |
| (11) Shadow-bands. | |
| (12) Meteorological observations. | |

NORMAN LOCKYER.

(To be continued.)

NOTES.

THE list of "New Year's Honours" includes the following names of men distinguished by their scientific attainments :—The dignity of a peerage has been conferred upon Sir John Lubbock, Bart. Dr. Lauder Brunton has received the honour of knighthood. Captain Abney has been promoted to a Knight

present to the Rev. Prof. Wiltshire, the hon. sec. of both the above-named societies, his portrait in oils, an illuminated address, and a cheque for 138*l.*—the balance of the sum subscribed after defraying expenses—in recognition of the services rendered by him to these societies and to palæontology and zoology during a period of more than thirty years. The portrait was executed by Miss Atkinson; the illuminated address by Miss G. M. Woodward. Among those present were Dr. Henry Woodward, F.R.S., President of the Palæontographical Society, the Rt. Rev. Bishop Mitchinson, Master of Pembroke, Oxford, Prof. T. McKenny Hughes, F.R.S., and Prof. W. J. Lewis, the Rev. R. A. Bullen, the Rev. G. F. Whidborne, V.P. Pal. Soc., the Rev. H. H. Winwood, Dr. W. T. Blanford, F.R.S., Mr. John Hopkinson, Prof. T. Rupert Jones, F.R.S., Sir Owen Roberts, Dr. D. H. Scott, F.R.S., Mr. F. W. Rudler, F.G.S., and Mr. A. Strahan; many ladies were also present. The presentation address was made by Sir John Lubbock, and the Rev. Prof. Wiltshire responded. Speeches were also made by Dr. Woodward, Prof. T. McKenny Hughes, Rev. G. F. Whidborne, and the Rev. H. H. Winwood; 132 subscribers took part in the testimonial.

A CONGRÈS d'Histoire des Sciences will be held in connection with the Paris Exhibition. As the development of all branches of scientific knowledge will be considered, the Congress will be of wide interest. Prof. Paul Tannery is the president of the